November 26, 2006

The Antarctic Sun

Published during the austral summer at McMurdo Station, Antarctica, for the United States Antarctic Program

The ANDRILL drill camp on the Ross Ice Shelf.

ANDRILL seeks core records to predict ice changes

ANDRILL educates, page 4

ANDRILL goes deep, page 13

ANDRILL gets support, page 17

Story and photos
by Peter Rejcek
Sun staff

The storybook of geologic and climatic history in Antarctica is a dirty one. It's a vari-colored array of sediment including mud, sand, rounded pebbles, fossilized diatoms and forams, volcanic ash and minerals.

That list is just a short selection of the material being drawn out of the seafloor beneath the Ross Ice Shelf by the ANtarctic geological DRILLing program known as ANDRILL. A small, international army of scientists, support staff and professional drillers make up ANDRILL,

Story continued on page 7

Marching to a different beat

Herzog after the unseen Antarctic

By Steven Profaizer
Sun staff

Werner Herzog lists the U.S. Antarctic Program orientation video on the very short list of Antarctic films he has seen. The prolific German director, who has made over 50 films in his 45-year career, said he avoided watching movies about Antarctica before heading to the Ice.

"I wanted to come here and get the surprises," the 64-year-old Herzog said. He is at McMurdo Station this season filming a documentary about life and science on the continent as part of the National Science Foundation's Antarctic Artists and Writers Program.

His forthcoming film is backed by the Discovery Channel. It will be his sixth film completed in five years and his first documentary since 2005's "Grizzly Man."

Herzog said he is not just an observer in his documentaries. Instead, his interests and fascinations guide his films, and his documentaries reveal their director along with their subjects. The tempo of each film varies as he takes the scenic route to the feature's destination. He said he is discovering exactly what his

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Quote of the Week

"The cargo ship isn't coming just to take away your food scraps."

— Man commenting on pile of leftovers on a plate.

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The dog days of Alaska
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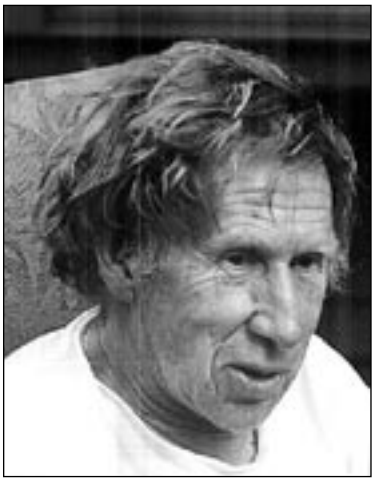
Cancer claims ice core pioneer



Bruce R. Koci

Dedicated ice core driller and engineer Bruce Raymond Koci died Nov. 13, 2006, in Madison, Wisc., as a result of non-Hodgkin's lymphoma.

His career in the ice core field spanned more than 30 years, including the Ross Ice Shelf, AMANDA and IceCube projects. He created the IceCube hot water drill now being used at the South Pole to construct the world's largest neutrino detector.

Koci was a member of teams that drilled in Peru, Bolivia, Tanzania, Tibet, China, Greenland and Baffin Island, as well as Antarctica.

Told that the Quelccaya Ice Cap in the Peruvian Andes was too high for humans and that technology did not exist to drill it, Koci designed a lightweight solar-powered drill and drilled a core to bedrock.

Memorials on the IceCube Web site remembered Koci as tough, legendary, loyal and the owner of an unrestrained creative imagination.

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Cold, hard facts

ANDRILL

Number of programs related to ANDRILL: **21**

Number of ANDRILL acronyms: **55**

Number of countries involved in ANDRILL: **4**

Mast height of drill rig on jack-up platform: **20 meters**

Drill rod pull capacity: **9 meters**

Weight of drill rig and platform: **40 tons**

Main winch capacity: **30 tons**

Total cost of drilling system (including drill pipe and ancillary equipment): **$3 million U.S.**

Current budget (two-thirds for research, education and out-reach; one-third for operation): **$30 million U.S.**

Source: The ANDRILL program media guide

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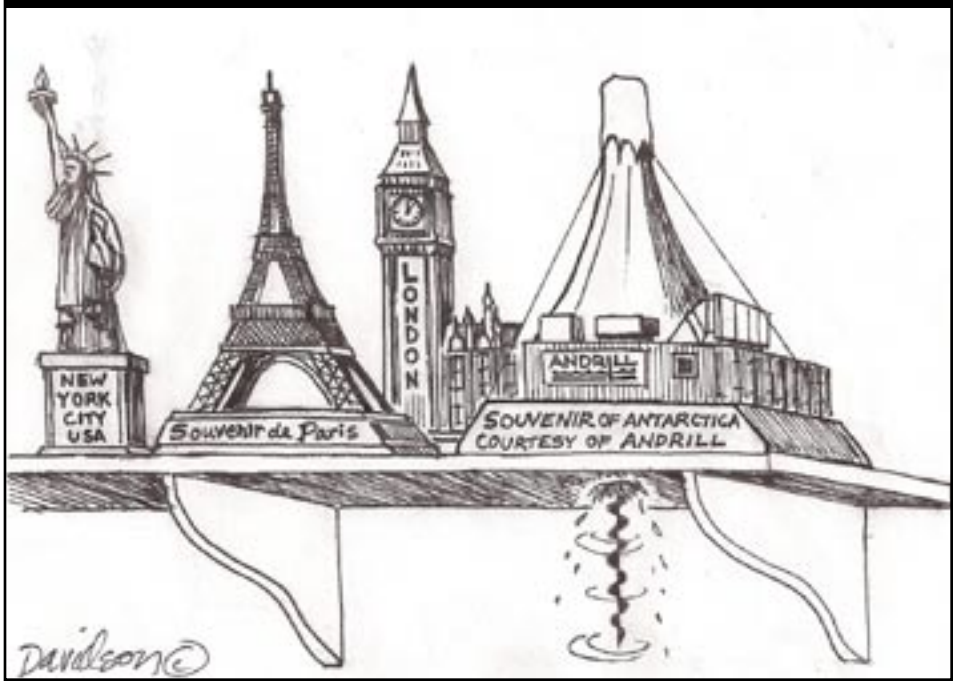
Level 1 Comix **Matt Davidson**



‘How do they do that?’

Team uncovering strengths of Antarctica’s toughest resident

By Steven Profaizer
Sun staff

Very few creatures can claim to be as tough as Antarctica’s largest year-round land animal. It can survive extreme dehydration, freezing and weeks without oxygen.

So, which beast can withstand such a bruising and be the reigning king of Antarctica?

Belgica antarctica – a flightless fly.

This 7- to 8-millimeter-long midge lives on the Antarctica Peninsula and lays claim to the title of the insect distributed farthest south in the world.

“Why can it survive here where we don’t find other insects? How can you be tolerant to so many stresses all at once and still be able to undergo normal feeding and growth?” said Rick Lee, principal investigator of a science project studying this incredible survivor. “We’re here looking at an animal that’s absolutely living on the edge at a place where other insects cannot survive.”

This is Lee’s second stint on a project studying the midge’s coping capabilities. He first came to Antarctica as a post-doctoral fellow in 1981 and documented the midge’s tolerance to various environmental stressors.

“The plan for our new project, some 25 years later, is to come back and take a look at these adaptations with new molecular tools and more sophisticated physiological techniques to address, ‘how do they do that?’” he said.

Lee is collaborating with Dave Denlinger from The Ohio State University for his current project. Their research focuses on the midges’ resistance to extreme temperatures and dehydration – both observations with roots in the 1981 project in which he was involved.

“You could dry a midge out to 35 percent of it normal body mass,” he said. “It shriveled up like a little raisin, but yet when you added water to it, it plumped back up, wiggled away and was doing just fine.”

The project is in its third year, and new molecular techniques have allowed researchers to identify the year-round presence of stress proteins.

Such proteins are only activated in most organisms when cells are under stress. When this response occurs, cells normally shut down all their routine forms of protein production, but the midge appears to be producing these stress proteins while its cells continue to function normally.

“It tends to be you’re either in a stress mode and trying to survive or it’s business as usual,” Lee said. “It was remarkable to find that these stress proteins were being produced at the same time that normal growth, feeding and developing were occurring.”

Photos courtesy of Robert Lee / Special to *The Antarctic Sun*

Above, two specimens of Belgica antarctica *mate during their brief lifespan as adults. The species is the most southerly distributed insect in the world and has the ability to withstand a wide spectrum of environmental stressors.*

Left, Rick Lee is the principal investigator for the project studying the coping capabilities of the Antarctic midge.

Only a few animals demonstrate this ability, and Lee said all of them, including a fish and a protozoan, live in the Antarctic. Lee said he wants to try to discover why that is the case – is living in the Antarctic so constantly hard on the system that some animals require these proteins all of the time, or is it that they are exposed to intermittent periods of extreme conditions and so they have to be prepared?

It takes two years of growing and feeding for the midges to complete their metamorphosis to adulthood. They have a spotty distribution on the Antarctic Peninsula and can be located in a variety of microhabitats. Lee’s group has found them in conjunction with algae, penguin guano and an Antarctic grass.

“They really get into a lot of different habitats,” Lee said. “It suggests that maybe generalists do better in really rigorous, living-at-the-edge environments.”

After the midges make it to adulthood, the payoff is short-lived, as they only have seven to 10 days to mate and lay eggs before they die.

Belgica antarctica is part of the *Chironomidae* family, a group of insects well known for its stamina. *Polypedilum vanderplanki*, another member of this family, is found in African deserts and can lose 99 percent of it body mass to dehydration and live to tell the tale.

Unlike many other chironomids, which fly briefly during their life cycle, the Antarctic midge remains wingless.

Wings are certainly an important trait of flies, but Lee said the rest of a midge’s anatomy keeps it firmly in the fly category. And since its relatives have wings, the Antarctic midge probably had them at some point and lost them secondarily.

“It’s very expensive to support flight muscles and wings, and without them they can use that energy for growth and reproduction instead,” Lee said. “If you take a look at many insects that live on islands, mountaintops or places where it’s very windy, there’s strong natural selection against flight. We often see a reduction in flight muscles and a shortening of wings – a tendency toward flightlessness. In this case, it went as far as to completely do away with the wings.”

Lee said he hopes that the unassuming midge may allow us to learn more about how it can be so tough, specifically when it comes to the freezing of its tissue. There are only a few animals that can withstand freezing without sustaining damage, and most of them have that ability to a much lesser degree than the midge.

“If we study freeze-tolerant models,” Lee said, “they may give us some clues … as to how we might cryopreserve human tissues and organs.”

NSF-funded research in this story: Rick Lee, Miami University, www.units.muohio.edu/cryolab/education/antarctic.htm.

ARISE-ing to the challenge of education

By LuAnn Dahlman
Special to the Sun

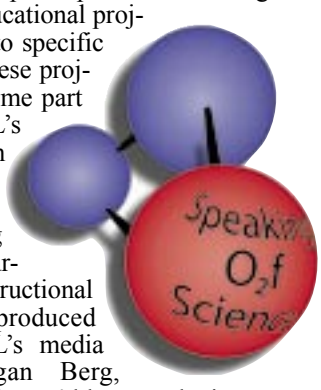
The ANDRILL team is doing excellent science and has a program in place to tell the world about it: six science educators from four countries are at McMurdo Station, participating in the research and sharing their experiences with a range of audiences across the globe.

The program is called ARISE – ANDRILL Research Immersion for Science Educators. Working daily as members of science teams, the ARISErs are genuinely immersed in current geologic research. We work side by side with the scientists, gathering data to coax out the array of stories the core has to tell about such things as tectonics and climate change. We contribute by performing chemical analyses, preparing microscope slides, counting and classifying stones (clasts), and searching core material for microfossils. We even get to do exciting tasks like using the rock saw to split the meter-long sections of core into two halves – it's great to be the first one to have a look at the exposed sediment layers!

Megan Berg / Special to *The Antarctic Sun*

Members of the ARISE program are on the Ice with ANDRILL this summer to be immersed in the science and help spread the news of ANDRILL through education programs. Standing in the back row, from left to right, are Julian Thomson, Betty Trummel, Alexander Siegmund and LuAnn Dahlman. In the front row are Vanessa Miller and Matteo Cattadori.

In addition to working with the science teams, ARISE participants are working on individual educational projects targeted to specific audiences. These projects will become part of ANDRILL's contribution to the educational community. Along with video journals and instructional multimedia produced by ANDRILL's media master, Megan Berg, ARISE participants' blogs, Web sites, presentations and activities will be available for classroom use and informal learning through the Project Iceberg Web site (www.andrill.org/iceberg). When the International Polar Year (IPY) kicks off in March 2007, we'll have educational content available to inform and inspire students of all ages about Antarctica and geologic drilling.



Though we come from a wide range of educational situations, we each have the goal of communicating the excitement and importance of ANDRILL's science to people beyond Antarctica.

ARISE participants

Vanessa Miller teaches fourth- and fifth-grade students at Central Park East 2 in New York City. Her school occupies the fourth story of a five-story building in east Harlem. As the playground is made of concrete, she and her class walk the short distance to Central Park in order to learn about the natural world. Vanessa is preparing a series of professional development seminars on polar science and geology for elementary school teachers in New York. She is also cultivating opportunities to involve her students in authentic science research.

Julian Thomson teaches Earth science and outdoor activities at a Steiner School in Lower Hutt, New Zealand. He worked as a field assistant on the 2005 ANDRILL project to map the drill site target for next season's work on the sea ice. Julian makes it a priority to hike one or more of the trails around McMurdo almost every day – he's often seen with a strange-looking camera above his head, recording the view in 360 degrees. He is working on a curriculum book about Antarctica and collecting interviews and other audio files for podcasts.

Matteo Cattadori teaches 13- through 16-year-old students in Trento, Italy. He is working with 31 schools, building a Web site to provide them with content and challenges that students can use for their end-of-year projects. He has produced photo galleries, audio files and videos to document his work with ANDRILL. Matteo's Web site (http://progettosmilla.it) is called ProgettoSMILLA after the book "Smilla's Sense of Snow."

Betty Trummel teaches fourth-graders at Husmann Elementary School in Crystal Lake, Ill. She participated in Teachers Experiencing Antarctica and the Arctic in the Cape Roberts Project in 1998, a previous geological drilling project. She is a prolific blogger, posting daily explanations and photos of ANDRILL science processes. She also posts descriptions and photos featuring the work of various departments around McMurdo. Betty is developing a series of presentations and short courses to share the ARISE experience with an international audience of teachers. She is also producing two books that describe ANDRILL and Antarctica for elementary school children using an alphabet format.

Alexander Siegmund is a professor of geography who teaches pre-service teachers in Heidelberg, Germany. He is working with television, radio and newspaper companies to tell the story of ANDRILL to a broad audience. His descriptions, photographs and video footage will publicize the importance of scientific research on climate history. His media contacts are writing articles and producing documentaries to air on German television and radio.

LuAnn Dahlman lives in Mesa, Ariz., and works for TERC, a non-profit educational research and development firm. She develops Earth science curriculum materials and teaches technology-based professional development programs for teachers. LuAnn is developing computer-based activities for geology students and a book of hands-on learning activities. She is a co-principal investigator on an IPY project that will produce a NOVA documentary on ANDRILL plus an innovative outreach package called the Flexhibit. The Web-accessible Flexhibit content will prepare youth groups to host IPY science events in their communities.

For further information on ANDRILL's education and public outreach efforts, contact ANDRILL's EPO coordinator, John Jackson, at jjackson9@unl.edu.

around the continent

SOUTH POLE

Volunteers keep the mail coming

By Susannah Coates
South Pole correspondent

The week has been a busy one at the South Pole. In the dining hall, previous years' amateur film festival entries received an enthusiastic reception last Saturday night.

The purpose and findings of the BICEP telescope were illuminated in the weekly science lecture – Cosmic Microwave Background, beginning of the universe, that sort of thing. Weather at Pole and McMurdo has jumbled the flights and provided both welcome down-time and double-time as work has piled up with the uneven schedule. Science studies, cargo handling, waste disposal – you can hear the hum of hard work all around station.

One of the most important efforts for logistics and morale is in the mail room. The South Pole post office is the gateway to the world, allowing Polies to send those all-important letters home and receive care packages and gear they didn't check in their luggage.

Postmistress Rose Meyer presides over the window of the southernmost official U.S. Postal Service office on the planet. She dons her official sweater, throws a good CD on, sets up the scale and is open for business. With only a day and a half of training in McMurdo to prepare her, she is a natural.

"I love working in the post office. I'm such a geek about it these days, too. I even get to wear the sweater with the useless pockets in front!" she said. Cheerful, engaged and low key, she weighs outgoing packages, tallies up postage due, participates in lively chat over which stamps to choose, and calmly deciphers what labels and stickers should go where on a package.

Incoming mail is vital to life and operations at the South Pole. With a 75-pound weight restriction on checked luggage for most program participants, many people mail extra gear and goodies down to themselves or make purchases online and have them shipped.

Scot Jackson / Special to *The Antarctic Sun*

Workers prepare to deliver new arrivals' luggage by snowmobile to the Amundsen-Scott South Pole Station earlier this month.

And soon after the summer season is in full swing, the holidays roll around. Even for those who aren't much into Christmas, a letter or package from home is an invaluable boost. When crates of mail arrive, as many as 50 people (that's over a fifth of the population here) descend upon the station's main entrance, called Destination Zulu, and form a human chain up the stairs and into the front hall, passing boxes hand to hand, laughing and shouting as they see familiar names scrawled under the clear packing tape.

Official as it is, no contract position exists for a postmistress or postmaster, and so the post office, to misquote a good phrase, depends upon the kindness of strangers. Beth Watson, South Pole station support supervisor, has worked in the post office for two seasons. At the beginning of each summer, she hopes to find a sturdy volunteer or two among the incoming crew willing to give a bit of time on evenings and weekends and learn the ins and outs of the postal code. So far, the post office has never failed to open.

PALMER

Palmer hosts groups of guests

By Kerry Kells
Palmer correspondent

The *R/V Laurence M. Gould* stopped for just a day at Palmer Station this past week to bring the Antarctic Treaty inspection team for a visit.

See CONTINENT on page 6

the week in weather

McMurdo Station
High: 30 F / -1 C
Low: 10 F / -12 C
Min. wind chill: -8 F / -22 C
Max. sustained wind: 32 mph / 52 kph

Palmer Station
High temperature: 38 F / 3 C
Low temperature: 25 F / -4 C
Max. sustained wind: 30 mph / 48 kph
Melted precipitation: 1 mm

South Pole Station
High: -17 F / -27 C
Low: -44 F / -42 C
Peak wind: 30 mph / 48 kph
Max. physio-altitude: 3,275 m

Continent

From page 5

The team included representatives from the National Science Foundation (NSF), U.S. State Department and U.S. Environmental Protection Agency. Al Sutherland, NSF representative, returned to Palmer Station for this short visit, having last been to Palmer in 2001. The group toured the station, took a boat trip to some of the local islands and hiked up the local glacier.

The *Gould* visited Petermann Island field camp, Vernadsky Station and arrived at Rothera Station last Sunday. Our facilities engineer Steve Wickins departed Palmer while we received eight new arrivals.

Also in the past week, Palmer received a visit from the captain and officers of the *HMS Endurance*, a British Royal Navy ship that supports the British Antarctic Survey science program. The ship, a 6,500-ton icebreaker, was not visible from Palmer Station. Its helicopter, however, flew to Palmer and landed in the "backyard."

The visitors attended a reception in the lounge. They presented the station with a plaque and a framed photograph of the *Endurance* in Antarctic waters. They also showed video footage of their flights over icebergs, cliffs and whales in the Antarctic. One short part of the video was overhead footage of whales gathering krill. The video was shot for parts of the Planet Earth series with David Attenborough produced by the BBC.

Palmer began the weekend with beautiful weather and still winds. The bird researchers have completed their "peak egg" counts for Adélie penguins on the local islands, as well as on Dream Island and Biscoe Point, which are farther from the station.

Peak egg counts are completed soon after the greatest number of nests have been initiated and give an estimate of the total number of Adélies breeding in the area. Local island counts are estimated at around 3,800 breeding pairs; counts on Dream and Biscoe, scientists say, have not yet been tallied.

Frank Howell / Special to *The Antarctic Sun*

A helicopter from the HMS Endurance *sits in Palmer Station's "backyard." The* Endurance *is a British Royal Navy ship that supports the British Antarctic Survey science program.*

Blue-eyed cormorants are tracked locally on Cormorant Island but are more difficult to census. Scientists estimate fewer than 50 breeding pairs.

Also this past week, Langdon Quetin and team member Kelly Moore successfully dove again at the *Bahia Paraiso*, the Argentine ship that sunk off Palmer Station many years ago.

The Wednesday night lecture was an amateur video of the sinking of the *Bahia Paraiso*, shot by a tourist on the ship when the *Bahia* struck ground and began to sink in January 1989. The hull of the *Bahia* is still visible above water in front of DeLaca Island, and one can even see the propellers underwater during calm conditions.

The community is now preparing for its first tourist cruise ship of the season and the Thanksgiving holiday.

SHIPS

NBP

The *R/V Nathaniel B. Palmer* worked its way out of the annual pack ice this week and along the edge of the Ross Ice Shelf. On Nov. 15, the crew deployed a sampling device for trace metals. But it wasn't long until the lines to the device froze, and it had to be recovered prematurely. Later in the day, a Zodiac boat was launched to perform the tests in lieu of the sampling device.

The *NBP* continued moving east over the next several days with regular tests being conducted along the way. The plan was for the *NBP* to then head to the edge of the fast ice shelf, but a bad turn in the weather delayed the trip. The winds increased to a sustained 93 kph with gusts over 111.

LMG

The *R/V Laurence M. Gould's* smooth crossing of the Drake Passage came to an abrupt end Nov. 15. As the ship approached Cape Shirreff, the wind sped up and shifted to the east, whipping up the ocean into steep breaking waves.

The *LMG* arrived at Palmer Station the following day on a much friendlier sea with clear skies and light winds. After cargo off-load and on-load was complete, the crew took time to eat dinner with the rest of Palmer Station before departing.

The team arrived at the United Kingdom's Rothera Station on Nov. 19 after a brief stop at a science camp on Petermann Island.

The *LMG* spent most of the following day at Rothera's pier before heading back to Palmer to pick up three passengers.

Continental Drift

What will future historians say about present-day life at your station?

"You had a glacier?"

Bob Farrell
Palmer area director
Littleton, Colo.
16th season

"Wow! They didn't have any swimming pools?"

David R. Pacheco Sr.
McMurdo plumber
Rio Rancho, N.M.
fourth season

"They will have to compare our station experiences to life at 'current' space stations: confined living quarters populated by crazy adventurers, "grow your own meal" greenhouses and probably more ECW than required for a space walk!"

Cathy Morrell
South Pole
fuels operator
Burlington, Vt.
first season

Drilling Back to the Future

Science at Work

Micropaleontologist Reed Scherer examines diatom fossils under the microscope at the Crary Science and Engineering Center at McMurdo Station on Nov. 21. Scherer and other paleontologists can help date sections of the ANDRILL sediment core based on the fossils they can identify. Recent sections of the core have been rich in diatoms, which are planktonic algae.

From page 1

a program studying the effect of climate change on the continent's ice mass. The team consists of about 80 people spread across McMurdo Station, New Zealand's Scott Base, and the drilling camp on the ice shelf. Several hundred more scientists around the globe are also involved in the landmark initiative to explore an area where little work has previously occurred.

The program represents one of the National Science Foundation's biggest investments for the International Polar Year (IPY), which officially begins March 2007. The IPY will actually run for about 24 months, highlighting polar science with an emphasis on international collaboration between nations conducting research here and in the Arctic.

ANDRILL is one of the big stars of the Antarctic show, a $30 million investment in cutting-edge technology, including a new drill rig that allows the team to penetrate 85 meters of ice and keep that hole open for weeks at a time, a first for Antarctic geological drilling. (See related story on page 13.)

"This is certainly our first big IPY project, and this is the one that will have the earliest results," said Tom Wagner, the Antarctic Geology and Geophysics program manager for the NSF's Office of Polar Programs (OPP).

ANDRILL's objective this field season is to collect about 1,200 meters of sedimentary rock core below the seabed, which itself is at nearly a thousand meters underneath the surface of a permanent ice shelf and seawater column. The goal is quite ambitious. It would likely represent the longest sediment core extracted from Antarctica to date by a land-based operation if the team is successful.

The National Science Foundation (NSF) – with the national science programs of New Zealand, Italy and Germany – has funded ANDRILL for two field seasons. Next year, the operation will move to the McMurdo Sound sea ice and extract a second core of nearly equal length, though with an older geological history.

That project will represent one of the longest physical core recoveries beneath the sea ice in one season. In comparison, the Cape Roberts Project, a geological drilling program from the late 1990s, recovered about 1,500 meters over three field seasons.

The vertical cores precious to ANDRILL are one key to understanding Antarctica's recent climatic, glacial and tectonic history in a regional and global context. The story is a relatively brief one in terms of geological time, a span of maybe 7 million years – though, in this case, older isn't necessarily better.

The initial two-year program has many subplots, but its main theme revolves around past and future responses of Antarctic ice sheets and ice shelves to warming tempera-

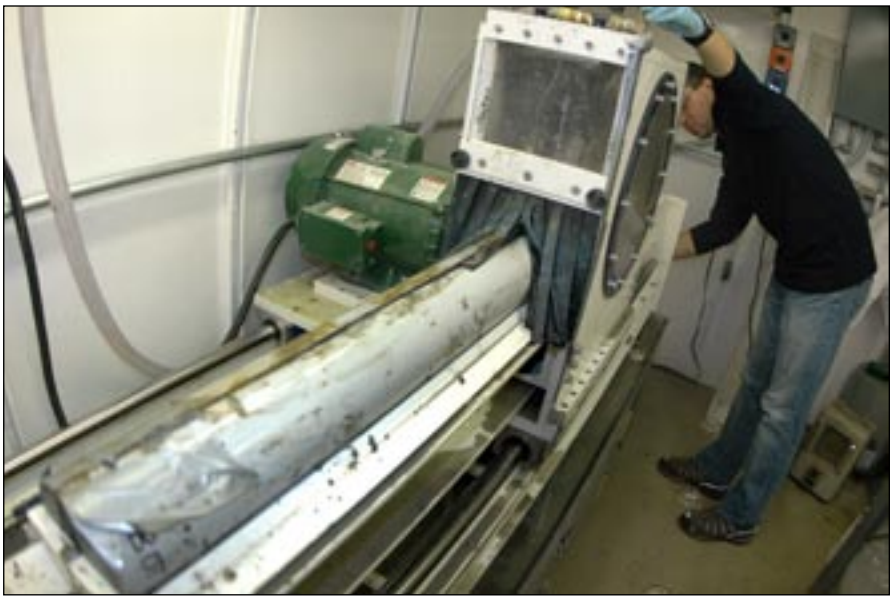
Continued on next page

Drilling Back to the Future
Science at Work

tures. Those events occurred in the relatively recent past, hence scientists are after very specific details they believe exist in the region's sediment cores.

"We're looking back, in a way, to look forward," explained Tim Naish, the co-chief scientist for this season's project on the ice shelf. The statement echoes ANDRILL's tagline – "drilling back to the future" – and refers to the team's effort to predict how today's ice shelves, as well as the West Antarctic Ice Sheet (WAIS), could respond to warmer temperatures in the future based on past behavior revealed in the sediment core.

The WAIS is a marine-based ice sheet, meaning that its bed lies well below sea level and its edges flow into floating ice shelves. The Ross Ice Shelf, the Filchner-Ronne Ice Shelf, and outlet glaciers that drain into the Amundsen Sea serve as its borders. It contains an estimated 30 million cubic kilometers of ice.



Core curator Davide Persico of Italy splits a one-meter section of sediment core only hours after it has been pulled out of the seafloor at the ANDRILL site on the Ross Ice Shelf.

Evidence and models suggest that the Antarctic continent was much warmer millions of years ago, so warm, in fact, that much of WAIS and its outlying ice shelves did not exist. Greenhouse gas warming could, sometime in the next century, match or even exceed those former, equally warm periods in the planet's past.

> "We treat this lab as a boat. We've got the team here altogether, all integrated, all focused, nobody distracted by the myriad things that you're distracted by in your home institution."
>
> *— Tim Naish*
> *ANDRILL co-chief scientist*

From ice core records, scientists already know that current carbon dioxide levels exceed those of the most recent warm periods, implying that the Earth may be reaching a tipping point of significant climate change that could affect Antarctica's ice mass. Best-case scenarios predict a global sea level rise of at least five meters should WAIS disintegrate. If successful, ANDRILL should be able to offer a good picture of exactly what conditions were like in the past to cause such a catastrophic breakup.

"That's why this project is so important," said Wagner, who is currently at McMurdo Station as the NSF OPP science representative.

The past and future parallels beg a long list of questions: What is the temperature threshold for potential collapse? What could the rate of collapse be? How will the deterioration of the ice sheet or ice shelves affect global climate as tons of cold water dumps into the oceanic circulation system? How might the much thicker and seemingly permanent East Antarctic ice sheet respond to the spike in temperature and increased amount of atmospheric carbon dioxide?

A diverse team

For scientists to get a better grip on those questions and many more, the ANDRILL program has assembled an international team, with members representing the United States, New Zealand, Germany and Italy. The crew boring through the Ross Ice Shelf and down into the seafloor from the drill rig are professional drillers from New Zealand.

The scientists represent nearly every geo-science field imaginable. There are structural geologists who are experts in reading the cracks in the core, differentiating between drill-induced fractures and those that indicate ancient fault lines. Paleontologists study the fossilized organisms, which help with dating segments of the core. Sedimentologists can describe the sediment properties that make up the core and infer past environmental changes, while the volcanologists provide insight into the area's volcanic history and use volcanic ash to assist further with dating elements of the layers. Petrologists study minerals and fragments of older rocks contained in the sediments of the core, which can say something about where the ice has brought the sediment from in Antarctica.

"It's pretty diverse," Naish said of the team, which is large enough to crowd most of one wing in the Crary Science and Engineering Center as well as an entire McMurdo Station dorm building for housing.

There are about 58 scientists and support staff, not

Continued on next page

Drilling Back to the Future
Science at Work

Sedimentologist Lionel Carter points out salient features on the exposed face of a one-meter-long core. He conducts "core tours" for the other ANDRILL scientists, describing layers that might indicate such things as volcanic ash or microfossils.

including the drillers, far dwarfing any other science group dedicated to one project on the continent. Naish said it's important to have such a large team on the continent as the core emerges because there are a number of ephemeral properties that require immediate attention – such as recording and studying microbiology, sediment color, density, chemical composition and fractures – while the core is still fresh and whole.

Eventually, the core will begin to change and start to dry out.

"That affects the primary structure," Powell said.

Involving so many of the project's scientists in the early stages also helps with data synthesis, according to Naish. He likened the atmosphere to that on a marine research vessel, where scientists spend weeks at a time collecting samples and conducting laboratory work, all on site.

"We treat this lab as a boat," Naish explained. "We've got the team here altogether, all integrated, all focused, nobody distracted by the myriad things that you're distracted by in your home institution."

The process also proves the adage that a few dozen scientific heads are better than one. "All of the scientists get a huge amount of value out of what other people are finding," Powell said.

Getting the split

Drilling the core and pulling it hundreds of meters to the surface of the ice shelf are only the first steps in a methodical process to clean, cut, catalog and study the sediment layers for the immense synthesis to come.

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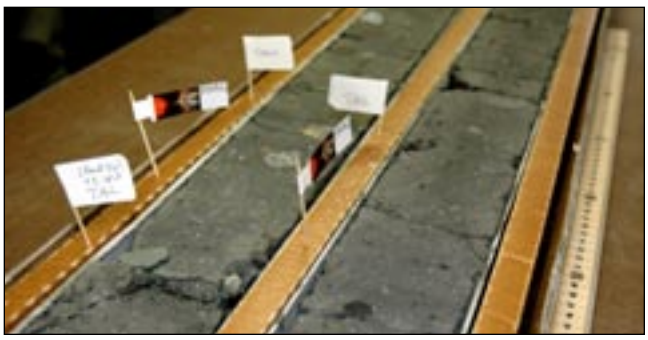


At right, scientists flag sections of the core they want to sample based on their field of study.

Drilling Back to the Future

Science at Work

Above, ANDRILL scientists Diane Winter, left, and Paola Maffioli work in the Crary Science and Engineering Center at McMurdo Station. Both are part of the team studying diatom fossils.

At left, ANDRILL core curator Matt Curren removes sections of the core to cut samples for scientists studying various features of the sediment layers.

Scientists at the drill rig site do some initial analysis of fracture patterns, image the core segments, and measure a variety of physical properties such as density and magnetism. Members of the curatorial team arrive at the site, a 45-minute drive from McMurdo Station, at least twice a day to collect the cores, which are cut into one-meter-long segments shortly after they are pulled from the borehole. By then, the core technicians – trained geologists – have placed the three pieces of each original three-meter core into long, flat metal boxes, which the curators drive back to McMurdo Station.

The next job is to split the core. One half will remain undisturbed, to be archived at Florida State University's Antarctic Research Facility. One of the curators will image the other half of the core, producing a high-resolution picture of the exposed face.

"We do a photograph of the face of the core because it changes color very quickly. It starts oxidizing," explained Matt Curren, assistant curator at the Antarctic Research Facility, which possesses a deep-sea core repository dating back more than 45 years.

The curators primarily work out of two ancillary buildings specially erected and modified for ANDRILL, just outside the front of the Crary Lab. A well-heated but cramped blue shipping container-sized building holds a table saw for slicing each meter-long segment into equal halves. An electronic track moves the core, now encased in PVC pipe, through the blade. Softer core samples arrive in plastic liners. Curren or one of the other curators, such as Italy's Davide Persico, cut those with a piano wire strung between two wood handles, the same sort of tool used by potters removing clay from a pottery wheel.

The assembly line then moves to the second location, a tent building that houses the core image scanner. The core half destined for dissection at Crary is placed on the scanner's cradle. A digital camera slowly moves along the length of the core, imaging at 100 pixels per centimeter. The other scientists can then examine the high-resolution photos to help them determine where they may want to draw samples. The images are also sent to other ANDRILL scientists off-site so they can request samples, which are shipped directly from McMurdo.

"They can keep up pace with the on-Ice scientists," Curren said. "It's impossible to bring everybody down."

The other machine in the tent building is an XRF spectrometer operated by Gerhard Kuhn from the Alfred Wagner Institute in Germany that uses X-rays to identify chemical properties from the archive-destined core.

"It's another way of doing analysis of the core non-destructively," said Curren, an experienced geologist who is unabashedly enthusiastic and animated about his work.

Continued on next page

Drilling Back to the Future
Science at Work

"The team won't know what hit them when they start getting 30 meters of core a day."

— Tim Naish
ANDRILL co-chief scientist

"We're really fortunate to have top-notch equipment, top-notch people from all around the world," he said while explaining the function of the core image scanner. "It's really exciting to be here. I love my job. This is the high point of my job is to come here, get out of the office and get core out of the ground."

Taking a closer look

Sedimentologists like Larry Krissek and Lionel Carter then enter the picture. Their job is to examine the exposed faces of the cores in conjunction with the data collected from scientists at the drill site and the analyses conducted by the curators. They provide general details on the strata composition, and point out pertinent discoveries such as layers of volcanic ash or segments with promising properties for finding fossilized organisms.

In some ways, they operate as interpretive salesmen, describing the most appealing features of a product to a diverse customer base – their fellow scientists.

"Our primary responsibility is to provide some descriptions … so they know where they can take samples and how to interpret the data," explained Krissek, associate professor of geological sciences at The Ohio State University. "We're in a service industry."

Most of the core description takes place at night, in part because it's a job that "requires few distractions," according to Krissek. The night of Nov. 14 required even more concentration, as the team believes it may have hit its first non-glaciated layer, which contained nearly a third of a meter of dark volcanic ash discovered nearly 100 meters below the seafloor bed surface.

The find is important for at least a couple of reasons. First, it will help the scientists better determine the age of where they are in the core. Presently, their best guess is "early Pleistocene," or up to 1.8 million years ago, with some estimating that they're only a million years in the past so far. Second, the ash represents a time when ice wasn't covering the surface of the seafloor, marking a warmer period when the ice shelf had apparently retreated or perhaps even disappeared.

"This ash is a major event," noted Carter, a professor of marine geology at Victoria University of Wellington.

Carter or Krissek presents each previous evening's findings to the majority of the team during its daily 9:30 a.m. meeting in the upstairs auditorium of the Crary Lab. The meeting is a mix of socializing, jocularity and theoretical discussion, wrapped up with a briefing on the previous day's core findings.

The group then files downstairs to a cargo receiving room, where the meter-long cores are laid out in cardboard boxes with thick sides, where the researchers stick toothpick flags alongside the length of the sample to stake claims for the bits and pieces that interest them. Carter leads the tours, where today's attention focuses on the ash layer find.

Sedimentologist Larry Krissek discusses details of the latest core from the borehole to fellow ANDRILL scientists during their daily meeting in the Crary Lab.

Paleontologist Reed Scherer and fellow colleagues who study microfossils of organisms like diatoms (planktonic algae) have been somewhat disappointed thus far in the sediment that's been pulled out of the borehole. "We like to see open marine stuff," he explained during a visit to the drill site on Nov. 13.

But just two days later, appearing fixated on a nearly indiscernible speck near the thick ash layer, he seemed pleased with what the seafloor was finally revealing. His work and that of other paleontologists is important for dating the core. They can match the fossils they identify with present-day species. The comparison will tell them what the climatic conditions may have been like based on what niche the species inhabits today. The scientists can then correlate those details with dated climatic records from other sources, such as ice cores, to stamp a specific timeframe on a particular layer.

Building on the past

The preliminary handling and core characterization is a 24-hour-a-day, seven-day-a-week operation. The curators and sedimentologists split 12-hour shifts to ensure someone is always available when new specimens arrive from the seafloor. The scientists working at the drill rig work similar schedules.

The rest of the ANDRILL staff can adhere to slightly less rigid schedules, though all work is dictated by the speed at which the core comes to the surface. The drilling crew just collected slightly more than 20 meters for one 24-hour period, the first time it has reached that benchmark.

The pace is only expected to quicken as the drillers bore down into harder material with smaller-sized bits, which should speed up the operation.

"The team won't know what hit them when they start getting 30 meters of core a day," said Naish, with the Institute for Geological and Nuclear Sciences and Victoria University of Wellington.

Naish and Powell, like many of the ANDRILL scientists, know the Herculean effort that is about to ensue as the output at the drill rig increases. Both were members of the Cape Roberts Project (CRP), a three-year drilling program that took place on the McMurdo Sound sea ice near Cape

Continued on next page

Drilling Back to the Future
Science at Work

Roberts, about 125 kilometers from McMurdo Station and Scott Base.

CRP was after much older sediment records and had different objectives. Specifically, the program investigated the early history of the East Antarctic Ice Sheet and the West Antarctic Rift System. In simpler terms, the seven-nation team wanted to know the last time when flora still flourished on the continent's edges.

"The holy grail has always been considered … getting this time, this boundary, in the rocks that represents the time when Antarctica went from being this green, warmish, vegetated continent to having an ice sheet," Naish said. The CRP didn't ultimately answer that question, but the three cores did provide evidence that East Antarctica had a cool, temperate climate with low woodland vegetation from 34 to 24 million years ago. It also found that the Transantarctic Mountains had achieved most of their present height by 34 million years ago.

"That's the nature of the science down here," Naish said philosophically. "You can guarantee whatever you find will be exciting and new, because so little is known, and we found some very exciting things in the Cape Roberts core, and I'm sure that will be the case here."

ANDRILL is a direct descendant of the Cape Roberts legacy, even down to where the first of the two planned drill sites will be located.

During geophysical surveys to determine where to drill for the CRP, scientists discovered an interesting basin on the ice shelf between Black Island and White Island across the sound from McMurdo Station.

"It gave us a sniff of something interesting," Naish said.

The discovery turned out to be essentially a moat, a basin that rings Ross Island, where McMurdo Station and Scott Base are located. The scientists believe that moat captured young sediments, mostly shielding them from destruction from advancing glaciers.

"There are very few places in this area where you can capture that young history because most of them have been eroded when glaciers have advanced," Naish explained.

While the objectives of the two drilling projects are different, and some of the technology has advanced even in the relatively short interval, the programs operate similarly in many ways and a number of the scientists are CRP alumni.

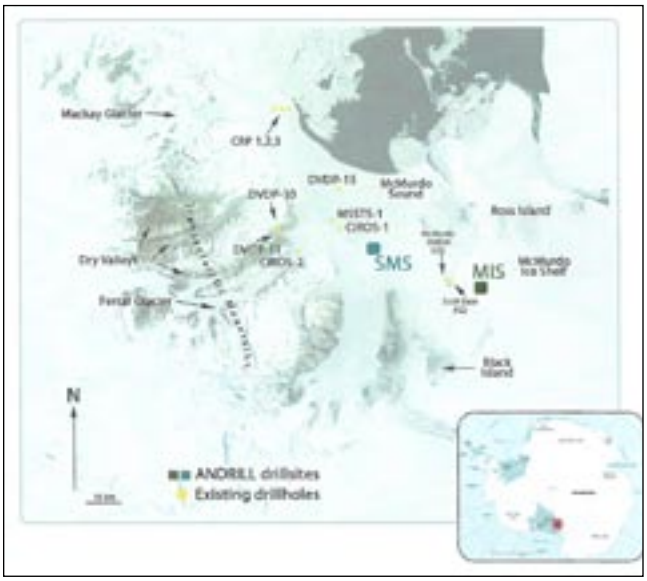
"The model for the way we do many things here follows on from the Cape Roberts Project," said Powell, with the Department of Geology and Environmental Geosciences at Northern Illinois University.

Preparing for the future

The ice shelf core is the first of two sites planned for the multi-million-dollar project. Next season, a similar-sized team with many new faces will drill for another 1,200-meter-long core farther away from the two Antarctic stations, this time on the much thinner sea ice through a water column about 500 meters deep.

Again, the focus will be on ice sheets and changing climate conditions, with an expected geological record stretching back approximately 17 million years. The setup will more closely mimic the CRP program, with many of the science staff living and working at the camp rather than in McMurdo.

Both drilling projects study the past but look to the future.



Graphic courtesy of ANDRILL/ Special to *The Antarctic Sun*

This map shows the two ANDRILL sites for the International Polar Year as well as previous geological drilling sites.

That theme is even echoed in the project's massive educational outreach arm, headed by John Jackson, the education and public outreach coordinator. Six international science educators are part of the ANDRILL team. (See Speaking of Science column on page 4.) The aim is to immerse the educators in the science so they can teach a new generation about Antarctica and climate change.

"We want to get the word out," Powell said. "We think the science is very important. Scientists are more and more expected to convey the information they're finding. … Having this component … is really critical because these issues are sometimes hard to get across to the public and the policymakers."

Drilling operations should wrap up by the end of December, but the scientific work is only beginning for the team. The ANDRILL staff will reassemble at Florida State University early next year before its next field season for a workshop, to add yet another page or two to the geologic and climatic history book of Antarctica.

"Every scientific drill core that has been [collected] is adding a little bit more to our global database," said Scherer, the diatom paleontologist.

Naish said the ANDRILL team would begin producing scientific reports even before members started leaving the Ice. He would hope to publish a major science paper eventually in a journal like Nature if the team could tease out details in the core that would identify the warmer periods along with information about ice shelf and ice sheet collapse, particularly the rate and nature of ice mass deterioration. Other potentially explosive finds would be evidence of previously undiscovered marine organisms that normally live in the warmer, lower latitudes.

"That would be a Nature paper, that would be a Science paper. That would be really exciting," Naish said.

NSF-funded research in this story: David Harwood, University of Nebraska-Lincoln. For more information about the program, go to www.andrill.org.

Drilling Back to the Future
At the site

Terry Wilson, foreground, holds a fractured segment of core together as it rotates on the core image scanner, a device that takes a 360-degree photo of the surface of the specimen, while Cristina Millan operates the scanning software. Both scientists are members of the structural geology team studying ancient fractures and drill-induced cracks in the cores at the drill site.

New drill represents future of Antarctic geology

Story and photos by Peter Rejcek
Sun staff

New Zealand driller Grant Brotherston has one ear cocked toward the towering drill rig covered with a white shroud. He's listening to the hum of the drill, where a diamond-flecked drill bit is working its way through rock and sediment more than 1,000 meters below the platform where he's standing.

"It's important to listen to it," he advises a visitor, one of many in the past few weeks who have made the pilgrimage to the ANDRILL site on the Ross Ice Shelf.

"When it gets unhappy, it starts to get noisy," he warns.

Right now, the drill sounds perfectly content, singing its persistent whine as it cores through the seafloor below. Core No. 44, three meters in length, should appear in the next couple of hours.

It's a bit dull once it's under way, this business of pulling core out of the ground. But boring is good when an operation has so many moving parts and variables. That's particularly true when the linchpin to the operation is a metal tube, called the sea riser, which connects the rig to the top of the seafloor, with nearly a thousand meters of ice and seawater separating the two ends. A number of things may foul up the drilling, from currents that cause the sea riser to bend and jam the drill to the unknown strata that could slow or frustrate the bit as it goes farther down.

The work-a-day atmosphere of the operation also belies the extraordinary technological and logistical successes that ANDRILL represents at the dawning of the 2007-08 International Polar Year.

ANDRILL is the National Science Foundation's first major IPY project. It fittingly features new technologies that will be used for not only ANDRILL but also future geological drilling programs, according to Tom Wagner, the Antarctic Geology and Geophysics program manager for the NSF's Office of Polar Programs.

This is the first time, he explained, that scientists have

Continued on next page

Drilling Back to the Future

At the site

Driller Grant Brotherston, left, and assistant driller/engineer Conrad Rains monitor the progress of the drill as it bores into the seafloor.

A group of used and new drill bits.

Drill rods await use just outside the ANDRILL building complex.

virtually unfettered access to the marine environment below the ice shelf, which is about 85 meters thick underneath the ANDRILL drilling platform. A new hot water drill system allowed the team of drillers to bore a hole through the ice. The real beauty of the hot water drill system, however, is its ability to keep that hole open around the sea riser throughout the operation.

"We anticipate drilling other holes around Antarctica with this technology," Wagner said, adding that other proposals for studying the marine ecosystem under ice shelves are coming forward, in part thanks to this advance.

"The way that science moves forward is that someone tries something new and succeeds," he noted.

For the drillers, the biggest challenge involved more tried and true technology – the sea riser. It took a couple of attempts before the drilling team successfully embedded the sea riser in the sea floor, according to Alex Pyne, ANDRILL drill site manager. However, it's now embedded in concrete about 17 meters below the surface.

"Getting the sea riser to the sea floor is always the primary operation in terms of setup," said Pyne, who also helped design the hot water drill system. "It's like a foundation for a house. You have to set the foundation first."

Under the big top

The approach to the drill site – where the multi-million-dollar geological project to extract 1,200 meters of ancient sediment is under way – doesn't offer much in the way of clues as to its function or purpose. (See related story on page 1.) The camp is located off the road to the Williams Field Skiway, about 12 kilometers from McMurdo Station and Scott Base. It's a tidy collection of United Nations-blue buildings, merely converted shipping containers, punctuated by a pearl-white circus big top.

Antarctica New Zealand is the project manager for the drilling end of ANDRILL. It has contracted Victoria University of Wellington and Webster Drilling and Exploration from New Zealand to lend their expertise for the multi-national project. A crew of 23 Kiwis works 24 hours a day, seven days a week, to meet a schedule that calls for producing 30 meters of core per day once the project is at full tilt.

"We've got a good range of experience," said Tamsin Falconer, the assistant drill site manager, about the crew.

The ANDRILL drilling system is a rig commonly used by the mineral industry, but customized and updated for the project's needs. It consists of a drill rig and platform, catwalk sledge and rod ramp, drill fluids system, cementing system, and external power supply, as well as the innovative hot water drilling system.

One of the modifications is the separation of the power supply, a 315-horsepower diesel motor to power the hydraulics, from the drill rig platform. That keeps the noise down under the big top where most of the action takes place, according to Pyne. The heated enclosure around the rig is another difference, a bow to the extremely cold temperatures and bitter winds that blow across the flat ice shelf.

"The hydraulics need to stay warm," Brotherston notes.

In fact, it's downright toasty warm in all the buildings, and virtually a sauna in the hot water drill system room adjacent to the drilling platform.

Continued on next page

Drilling Back to the Future
At the site

Handling the core: Core technicians Cliff Atkins (with the white hard hat) and Dene Carroll examine the core only minutes after it emerges from the borehole (below), then move it inside the lab at the drill site (at left), before cutting it into one-meter-long segments (below left).

"It's nice for the workers … because it's not exactly Antarctic conditions," Falconer said of the heated buildings.

In another module is the so-called mudroom, which pumps, circulates and recovers drilling fluid used to keep the drill bit lubricated. That part of the operation is a mixture of new equipment and components salvaged from the Cape Roberts Project, a related geological drilling program that ran from 1997-99.

The system is based on the use of seawater and environmentally friendly additives to provide a viscous fluid that keeps the drill moving. Cuttings from the hole are pumped into the mudroom and removed from the fluid using a centrifuge, so the mixture can be recycled.

Pyne said the technology used at the site is not necessarily new, though its design is unique, such as the jacked-up drill platform, which allows for tidal movements up to 1½ meters.

"[The drill site is] driven by what we are trying to achieve," Pyne explained.

Science on site

What ANDRILL is trying to achieve is a picture of the advance and retreat of ice shelves and the ice sheet from West Antarctica during warmer periods in Earth's past. That could help scientists predict how the continent's massive ice reserves may react to future climate change as the planet continues to warm. The project is also interested in adding details to the continent's tectonic and geological history.

That wide-ranging picture is months, if not years, away from coalescing. However, the research starts right at the drill site, where a handful of scientists rotate working around the clock. Their job is to make the initial analyses and measurements only minutes after the three-meter-long cores come out of the ground. Core technicians hand carry each specimen to the lab, where they slide the metal-encased core into the building through a small hatch in the wall.

"The science that we have at the drill site needs to be done before the core moves off site and is split in half," Falconer explained.

The first scientists to get a look at the core are geologists who specialize in tectonics and can identify structures in the fresh core that indicate ancient fractures or stress-induced breaks caused by the drill. Both types of cracks are useful to the geologists, but can only be analyzed while the core is still in one piece.

The ancient faults will provide a rift history of the area, according to structural geologist Tim Paulsen. In addition, the drill-induced cracks can say something about modern-day tectonic stress in the rock below the seabed.

"The drilling-induced fractures will orient themselves systematically with respect to the stress field within the crust," he explained, so that the

Continued on next page

Drilling Back to the Future

At the site

Germany's Frank Niessen, right, gives fellow ANDRILL scientists Reed Scherer and Percy Strong a tour of the multi-sensor track at the drill site. The machine can provide the researchers with details on the core's physical properties, such as density.

orientation of the crack will indicate the direction of the forces. "The drilling-induced fractures we're looking for really don't destroy the core; they're just places where fractures have propagated along the length of the core, yet have left the rock intact on either side of the fracture."

Terry Wilson is the other geologist who leads the core structure team, working nights with technician Cristina Millan, while Paulsen oversees the day operation with Andreas Laufer. She noted that the drill adds just enough additional pressure to unlock the natural forces acting within the earth.

"Orientations of the cracks that form are really controlled by the forces that are already there," Wilson said. "We can get modern-day forces and ancient forces."

After a cursory examination with magnifying glasses for fractures, the geologists then get the first picture of the core, which by now has been cut into one-meter lengths for ease of handling and transport. The core is placed between two rollers on a core image scanner. The rollers rotate the cylindrical sediment 360 degrees while a digital camera slides on a track taking images along the core's vertical length.

The result is a flattened image of the core's surface. The scientists will then match that image against a different kind of picture from a device called a televiewer, a special camera that uses sound waves to produce an image. The drillers will lower the televiewer into the borehole to capture details of its exposed walls after drilling is complete. The televiewer is fitted with a magnetic compass to orient the images so that they can be matched to the core images taken by the core image scanner.

The core moves on to a second room and is placed on a multi-sensor track that can measure various physical properties, such as its density and thickness. The top layers of the core, for example, have come out unexpectedly compact in the first 100 meters.

"For these young sediments, it is a bit surprising to me that they are so well cemented, particularly this layer," said Frank Niessen, leader of the core geophysical property team and one of Germany's national representatives to ANDRILL.

Many variables

Surprises will undoubtedly continue to mount as several hundred more sections of the core emerge at the drill site. Next season, the operation will move to the sea ice to extract a second 1,000-meter-long core. The sea ice is much thinner than the permanent ice shelf and will require careful management of the drilling rig to ensure success. Much will depend on whether the thick multi-year sea ice clears out of McMurdo Sound this summer, according to Pyne.

> "We can get modern-day forces and ancient forces."
>
> *— Terry Wilson, ANDRILL geologist*

There is a big difference between seven-meter-thick ice and sea ice that's only a couple of meters deep, he explained. The former would require extensive grooming to flatten the surface, like that required to establish the annual sea ice runway near McMurdo Station. The latter would need less maintenance but may put the squeeze on the amount of time allotted for drilling before ice melt threatens the operation.

"Our time limit is very similar to the sea ice runway in terms of operations," Pyne said, predicting a pullout date of early December when the sea ice starts to become unstable.

Back on the ice shelf this season, the drilling operation will continue through the end of December, and the crew is on pace to extract about 1,100 meters, just short of its original goal. But it's probably too early to foretell the final outcome at this point, especially since the preliminary coring requires an 83-millimeter-wide bit. As the drillers go deeper, into presumably harder rock, they'll switch to smaller-sized bits – one of 61 millimeters width and the final one of 45 millimeters – that should bore faster.

The rig is also capable of taking longer cores at a time, with six- and nine-meter capabilities. Expectations are high but so is the level of experience of the New Zealand crew, led by Pyne, who has been drilling in the Antarctic on such projects since 1979.

Jim Cowie, the ANDRILL project manager, summed up the operation thus during a recent meeting of many of the scientists in McMurdo: "I've been on a few drill sites through the years, and I've never seen one this well set up and environmentally friendly."

Drilling Back to the Future

PULLING IT OFF

Four nations cooperate on ANDRILL program

By Peter Rejcek
Sun staff

When the ANDRILL project first came across her desk about three years ago, Jessie Crain approached the science proposal like any other that requires logistical support from Raytheon Polar Services Co., the contractor that operates the U.S. Antarctic Program on behalf of the National Science Foundation.

But ANDRILL is not like other science events in Antarctica. Nearly 60 scientists and support staff will spend most of the austral summer at McMurdo Station. The group represents four nations – the United States, New Zealand, Italy and Germany – with different requirements, rules and goals.

It's up to Crain, as the ANDRILL project manager for Raytheon, and other support personnel in the company to ensure all of the ANDRILL team members arrive on schedule – a schedule that's constantly in flux – and receive the necessary support for a successful field season.

> "We have good support here."
>
> *— Jim Cowie*
> *ANDRILL project manager for Antarctica New Zealand*

"In some sense, it's easier for us to do everything," Crain said of the challenge of working across nations to pull off the ANDRILL program, one of the premiere events of the International Polar Year (IPY). "The thing that was really different about this was how big it was and that we weren't providing all the logistics."

Antarctica New Zealand (ANZ) shares a large part of the responsibility for logistics, being the only other nation with extensive infrastructure on Ross Island. Specifically, ANZ oversees the drilling end of the operation on the Ross Ice Shelf. (See related story on page 13.) Jim Cowie serves as the ANDRILL project manager on behalf of ANZ. A crew of about 23 New Zealanders makes up that end.

ANDRILL is studying the past and future behavior of Antarctica's ice mass in relation to climate change by drilling a sediment core 1,200 meters deep in the seafloor. (See related story on page 1.) The effort requires a drilling operation on the ice shelf, a large swath of lab space in the Crary Science and Engineering Center at McMurdo Station, and even the construction and modification of two ancillary buildings near the Crary Lab.

Peter Rejcek / *The Antarctic Sun*

The ANDRILL program requires two additional buildings in McMurdo for processing the core sediment from drill site. The building on the right is where the core is split in half. The Rac Tent to the left houses instruments to image the face of the core and analyze its chemical properties.

In addition, the ANDRILL program required additional support from normal McMurdo Station operations. For example, the fleet operations department built a new snow road to the drilling rig and compacted the snow pad for the facility. The shuttles department runs additional taxi van services from McMurdo to the site, about a 45-minute ride away from Ross Island across the ice. The large number of people also requires an entire dorm building dedicated to ANDRILL.

At Scott Base – a much smaller facility with an average population of about 40 during the austral summer versus McMurdo's roughly one thousand personnel – the additional people from the drill team is equally straining.

"This is the first time Scott Base has hosted a group as big as us in an around-the-clock operation," Cowie said, adding that the ANDRILL program even hired a third chef to work at Scott Base to lessen the impact to the normal day-to-day operations there.

The first couple of weeks were a bit rough, Cowie conceded, but everyone has settled into a routine. "We have good support here," he said.

Each nation's individual science program was also responsible for some level of support. For instance, each person who deploys to the Ice receives a medical physical to ensure he or she is relatively healthy because of the limited medical facilities here. Because each nation has its own medical protocols, individual science programs managed the physical qualification process separately. Each country was also in charge of outfitting its member in their own extreme cold weather gear, which differs from the ubiquitous red parkas of the USAP.

"It's part of the international flavor of the project," Crain noted. "You just don't want 58 people in red parkas. You want people to see that there are people here from other programs and that it does have that international collaboration."

ANDRILL is an ideal reflection of the IPY spirit, according to Tom Wagner, the Antarctic Geology and Geophysics program manager for the NSF's Office of Polar Programs. The IPY officially runs from March 2007 to March 2009. It focuses on international cooperation between nations for studying the polar regions and their role in the global ecosystem.

"We have a true collaboration between four nations [with ANDRILL]," Wagner said.

Ross Powell, one of the co-chief scientists for ANDRILL this field season, said one of his responsibilities, along with the other co-chief, Tim Naish, is to puzzle out how to organize such a large and diverse team that speaks at least three different primary languages.

"It's a real mix and match. That does create extra work just trying to

Continued on page 19

Henry Kaiser / Special to *The Antarctic Sun*

Werner Herzog, second from right, films scientist Sam Bowser, far right, at the New Harbor field camp for a documentary the German filmmaker is doing about Antarctica for the Discovery Channel. Manning the camera is Peter Zeitlinger, while one of Bowser's team members, Jan Palowski, looks on. Herzog says McMurdo is a community with "real life" in its people.

Herzog wants to avoid 'fluffy' Antarctic movie

From page 1

Antarctic documentary will focus on as he experiences the continent for himself.

"It's not going to be the Disney version of Antarctica, I'm sure of that," he said. "And it won't be the Discovery Channel version either, even though it will air on the channel. … For example, the sounds of the Weddell seals under the ice seem to be more intriguing than the fluffy little cubs next to their moms."

Herzog is looking past the obvious to find the odd questions that lurk behind the scenery.

He has found one such question in the occasional rogue penguin that marches away from its colony toward the heart of the icy continent, where it dies removed from food, water and companionship.

"I'm curious if there's such a thing as insanity or derangement among penguins," Herzog said. "Why do they do that? Are they insane? … Or did that particular penguin just have enough of his colony and want to get out of it?"

Like Antarctica itself, his documentary will be science-focused, and Herzog will spend time in the field with two science projects: Sam Bowser's group studying a single-celled organism that dwells at the bottom of McMurdo Sound and Phil Kyle's group studying Ross Island's resident volcano, Mount Erebus.

But science is not all that happens here. The scientists and support staff make up a vibrant Antarctic community, which has already piqued his interest – from McMurdo's ATMs to its aerobic classes.

"I'm equally interested in the kind of people who are working here and not just the scientists – they're only the tip of the iceberg," he said. "I'm interested in the people on the ground, like the men who drill the bore holes at ANDRILL. They all look like manly men with whom I want to be friends. You can tell from miles away that these men are reliable and good."

Herzog has found USAP's participants to be a documentarian's dream. He has been staggered by the amount of fascinating personalities and backgrounds in the program. Of the many places he has traveled throughout his lifetime, Herzog said McMurdo is one of the best examples of a community with "real life" in its people.

His ties to McMurdo predate his grant and his visit. A member of the McMurdo community actually created the spark of interest that would eventually bring him to the Ice.

Henry Kaiser has been part of McMurdo's dive team for the last three summers and works as a California-based musician when he is off the Ice. Kaiser is a diver with Bowser's group at New Harbor this season, but he originally got involved in the USAP as an Antarctic Artists and Writers grantee who came down to record a CD of instrumental guitar music inspired by Antarctica. Kaiser first met Herzog more than 20 years ago and later produced the music for "Grizzly Man."

"While we were recording music, I saw him walking around with an open laptop," Herzog said. "There were some

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Film goes below the surface and to the top of the Ice

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images on the screen, and, from a distance, I could tell there was something special about them. I stopped everything and rushed over, and it was footage from under the ice at New Harbor."

He said the images looked liked they were from another planet, and that is exactly how he decided to use them. Herzog used Kaiser's reels from under the Antarctic ice as footage of an alien water planet in his most recently released film, "The Wild Blue Yonder."

After seeing some of what Antarctica had to offer, he applied for and was accepted into the Antarctic Artists and Writers Program.

"When I was accepted, I immediately said I wanted to be the smallest team down here – only a cinematographer, who is essential, and a soundman," he said. "So I decided to be the soundman as well as the director. This way we wouldn't use much of the resources here, and we could be more flexible."

Herzog chose to bring Peter Zeitlinger, a cinematographer whom he has worked with on eight previous films.

He said his biggest challenge with being both soundman and director is his constant struggle with the technology. Herzog said he has no real interest in all the complicated electronics he has to deal with daily as soundman.

And while he will admit to being technologically out of focus, he has come a long way.

Herzog grew up in the rural mountain town of Sachrang in southern Germany and has never had formal training in cinematography. He made his first phone call at age 17 and did not even know cinema existed until a traveling projectionist visited his school when he was 11 years old.

"It's a coincidence, but the first film I saw was Eskimos building an igloo.

Henry Kaiser / Special to *The Antarctic Sun*

Werner Herzog and Peter Zeitlinger carry minimal equipment to be as flexible as possible while working.

Having grown up in the mountains, I immediately saw they were very bad at doing the job. They were clearly Eskimos that lived in a trailer park somewhere.

It was obvious they had never spent one night in a self-built igloo," Herzog said. "When I was at happy camper [USAP's survival course], I kept thinking about the first movie I saw. … I had to cut blocks of snow myself, and I had the feeling 'don't do it like the Eskimos you've seen in your childhood.'"

He plans to complete his Antarctic documentary by May 2007. Once he gets back to his home in Los Angeles, he will watch all the captured film and piece the feature together without trying to force it into a specific shape. He said he tries to take a passive approach and allow the strengths of the footage to emerge on their own. In that way, things he may have overlooked suddenly become essential.

"It's very hard to make a prediction on how the film is going to be shaped in the end. I just follow my fascinations as I work with the basic concept," he said. "I know there won't be any penguins in my film, unless I find a deranged penguin marching off to the mainland and his death."

NSF-funded projects in this story: Werner Herzog, USAP Antarctic Artists and Writers Program, WernerHerzog.com.

Public Premiere of 'RESCUE DAWN' in Antarctica

Werner Herzog will premiere his yet-unreleased film, "Rescue Dawn," at McMurdo Station on Sunday. The only other audience to see the film was at the Toronto Film Festival.

The movie stars Christian Bale and tells the true story of a U.S. fighter pilot, Dieter Dengler, who was shot down and captured in Laos during the Vietnam War. Dengler organized an escape for himself and a small group of POWs, including Duane Martin (portrayed by Steve Zahn).

"There is so much incredible human drama in this story," Herzog said. "I enjoy stories where there is a test and a trial of men."

Drilling Back to the Future

PULLING IT OFF

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figure out how that interaction works," Powell said. "It's a true integration of the scientists and nations."

The partnership and integration will continue into next season when the ANDRILL program moves to the sea ice, farther away from McMurdo Station and Scott Base.

"Next year is a little different because they'll be in another location, so the logistics will be a little bit different," Crain said. For one thing, the drill camp will require helicopter support because of the distances involved and the fact that a number of the scientists and drill personnel will live on site.

There are a few lessons learned that Crain will take home with her this season in preparation for the 2007-08 austral summer. For instance, nobody thought about the impact of squeezing six people in an office meant to hold half that number. Real office chairs have become a high premium these days around the Crary Lab, with some people making do with foldout chairs normally sent to field camps.

"On one hand, we've laid the groundwork for next season, but when it gets into the details, we'll have to plan those in the spring like we do for every other science project," Crain said.

Profile Couple follow ruff trail

McMurdo duo mushes dogs deep into Alaska's heritage

Dave Weimar / Special to *The Antarctic Sun*

As if wintering in Antarctica wasn't enough, Sara Russell and Dave Weimer spent the last Arctic winter mushing a team of dogs over a 700-mile stretch of Alaska.

By Bill Jirsa
Special to the Sun

Spending a winter in Antarctica might be challenge enough for most people. But for U.S. Antarctic Program participants Sara Russell and Dave Weimer, who first met during the austral winter of 2003 at McMurdo Station, a cold season at 77 degrees south was just a beginning.

The pair mushed a team of 11 dogs this year between Kotzebue and Coldfoot, Alaska, during some of the coldest, darkest months of the Arctic year.

Their journey traced often-dormant routes between villages along the Arctic Circle, where modern conveniences like the snowmobile have largely replaced the dying art of dog sledding. It also provided a challenge for a relatively new partnership, and an unforgettable test of constitution in a stunning and extreme environment.

The seeds of the trip go back to the season that Weimer, a Florida native, spent in Alaska. He responded to an advertisement in the Denali post office seeking dog handlers to work a winter in the Alaskan town that would become the launching point for their journey.

"I didn't even know what dog handling was," Weimer said. "Didn't know where Kotzebue was. Off the road, off the grid." He overcame his lack of experience with dogs and the Arctic, and the season led to dog sled jobs in resort towns of Colorado. All the while, Weimer retained his plans to return to the Arctic and complete a long dog sledding journey.

Russell, it turns out, shared Weimar's ambition for big adventure. So when the other mushers Weimer had selected for his trip backed out, Russell was eager to fill in.

"The previous summer, Dave bought a house, and we did a fix and flip together on it," she explained from the break room at the Joint Space Operations Center in McMurdo where she is a network administrator in the information technology department. Then she mimicked herself at the time: "Heck, if we can make it through that, we can make it through anything. We get along fine."

Weimer, who returned this season as a power plant technician, shot her a knowing glance and they both laughed.

"I was afraid by the end of it we'd hate each other." Weimer said. "It was definitely a risk for our relationship."

Weimer said he never missed an opportunity to convey the misery of what the trip would entail.

"I really made it sound as horrible as I possibly could," said Weimer. "I didn't want to leave anything unsaid."

For her part, Russell didn't want to be easily dismissed, despite her inexperience with mushing in the Arctic. "I thought, 'I'm a tough girl. I've climbed, ice-climbed, snow camped, worked in Antarctica.'"

But, she says, nothing prepared her for four months of living unassisted in the midst of a dark Arctic winter.

Long days of mushing in temperatures that sometimes reached negative 50 degrees Celsius were just the beginning. Each day's routine also involved overcoming the extreme cold while setting up camp, locating wood for fire, melting snow and ice, and feeding 13 tired and hungry mouths.

"Nothing has ever been so hard," she said. "It humbled me so much. Every day is a challenge. Nothing is important except getting your wood, getting your water," said Russell. "There's a beauty and a peace in that."

"These are pretty basic survival instincts that we all once had," Weimer said. "We've lost them in our computer age.

"It's a hard life, but it's a happy one," he added.

The couple didn't expect to be a source of curiosity for the locals along the way, where traveling long distances by dogsled is something of a lost art.

"Every family had dog teams," Weimar said about the ways of the Arctic cultures in the not-so-distant past. "Snowmobiles have really taken over.

"I can understand it if you can cover in three hours what took us five days."

Still, he observed with some dismay, it means that except for tourism and racing, the tradition of dogsled travel is mostly a memory.

"People don't travel like this anymore," Weimar said. "It was kind of relearning what dog mushing used to be. And in a lot of the villages we would go to, they were always amazed to see two people on a sled, and the elders and the older people would see us in town, mushing through main street or something and they would say, 'this is the way it used to be.'"

"[They would] ask about our sled, ask about the load, what line our dogs were," said Russell, referring to the lasting concern over the genealogy of sled dogs. Traveling as they did also endeared them to the close-knit communities of the Arctic Circle.

"They all knew we were coming," said Weimer. "By the time we started in Kotzebue, they knew we were going to arrive in Kobuk 200 miles away."

During some periods when temperatures were so blistering cold that the dogs couldn't run and the sled wouldn't glide, they relied on the hospitality of villagers for an occasional meal or hot shower, and in one incident, even a little canine dental work.

After nearly four months traveling, they emerged at Coldfoot, along the highway that parallels the Alaskan pipeline, roughly 700 miles from their starting point. Although it was short of their planned destination on the shore of the Arctic Ocean, the trip represents a formidable accomplishment and an unforgettable journey.

"You find out what you're made of," said Russell. "You find out what your limits are. You see your limits change and grow."

This year finds them back for another season at McMurdo, in a similarly cold environment where dog sledding is no longer allowed due to environmental concerns.

"It's helped revitalize my view of McMurdo," Russell said. "You have a hot shower, a bed and hot food cooked for you."